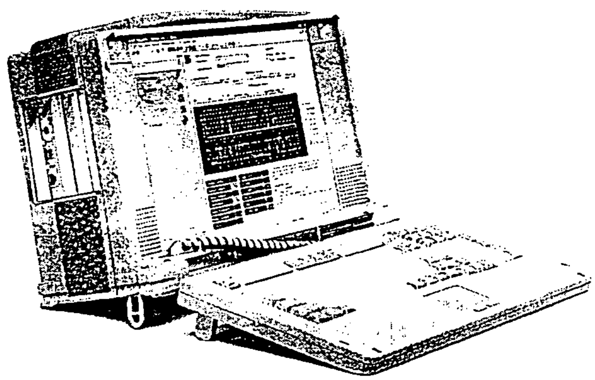
Agilent Technologies
Telegra R - VQT J1981A
Product Overview



The Comprehensive, Objective Voice Quality Tester

The Agilent Telegra VQT is an objective, end-to-end voice quality test system providing detailed test and analysis capabilities for voice quality on modern telephony networks, including VoIP, VoATM, and PSTN. Analog, T1, and E1 interfaces connect to the access points of the network to determine the key end-user quality parameters of any voice network: clarity, delay, echo, and others. The portable system is designed for engineers who develop, deploy and operate next generation voice network devices and services. The self-guiding user interface allows expert and novice users to easily execute tests and determine the success or failure of the test. Insightful reports and graphs will aid the user to quickly and easily:

- Identify faulty system components in voice networks and network devices
- Improve network and system performance
- Shorten development, deployment and troubleshooting

The Telegra VQT is a portable tester based on the Telegra R platform. To be used as a benchtop tester in the lab or portable tester in the field it is well suited when you:

- Develop voice systems such as voice gateways or PBXs
- Validate voice quality in QA and system integration
- Integrate voice gateways into IP, ATM or Frame Relay networks
- Install voice systems in public or enterprise networks or customer sites
- Troubleshoot voice networks in the field
- Operate and maintain voice networks

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Innovating the HP Way

Introduce New Products and Network Services Sooner

The Telegra VQT helps you get products and services to market earlier with higher confidence. Locate subtle problems early in development or deployment when they are much less expensive to fix. Telegra VQT's comprehensive test capabilities enhance product and service quality and reliability.

Shorten development, deployment, and repair times

- Fine tune your network equipment under real network conditions before field deployment - Measure the network behavior in a real network and simulate this behavior through the Telegra VQT in your lab
- Simulate network changes in the lab before deployment - Use previously captured network behavior and change network parameters such as delay e.g. to simulate additional nodes or longer routes
- Automate voice quality tests - Use provided test scripts, modify existing ones or develop your own
- Let your voice expert technicians/engineers troubleshoot and validate deployments throughout the country remotely - Remotely log into the VQT and access all functionality as if you were sitting right in front of the Telegra VQT

Objectively Compare and Improve Network and Systems Performance

For voice services of next generation networks such as VoIP to be accepted by consumers and corporate users, they have to provide comparable voice quality as the traditional phone networks. Telegra VQT provides you with the ability to objectively compare voice quality and to identify the influencing factors.

- Objectively measure voice quality from an end-user perspective - recreate the user experience by measuring end-to-end quality, connecting as close to your end-user as possible using analog FXO, analog E&M, T1, or E1 interfaces
- Fully load a dual-port T1 or E1 interface and measure voice quality and performance of a network or device under various traffic conditions
- Identify network components or behavior requiring improvements - after determining poor voice quality analyze in detail the clarity, delay, echo, silence suppression, comfort noise generation and DTMF tone transmission to identify what needs to be improved
- Determine the effect of network or system changes (e.g. traffic load or design changes) by easily comparing measurement results before and after the change

Key Functionality

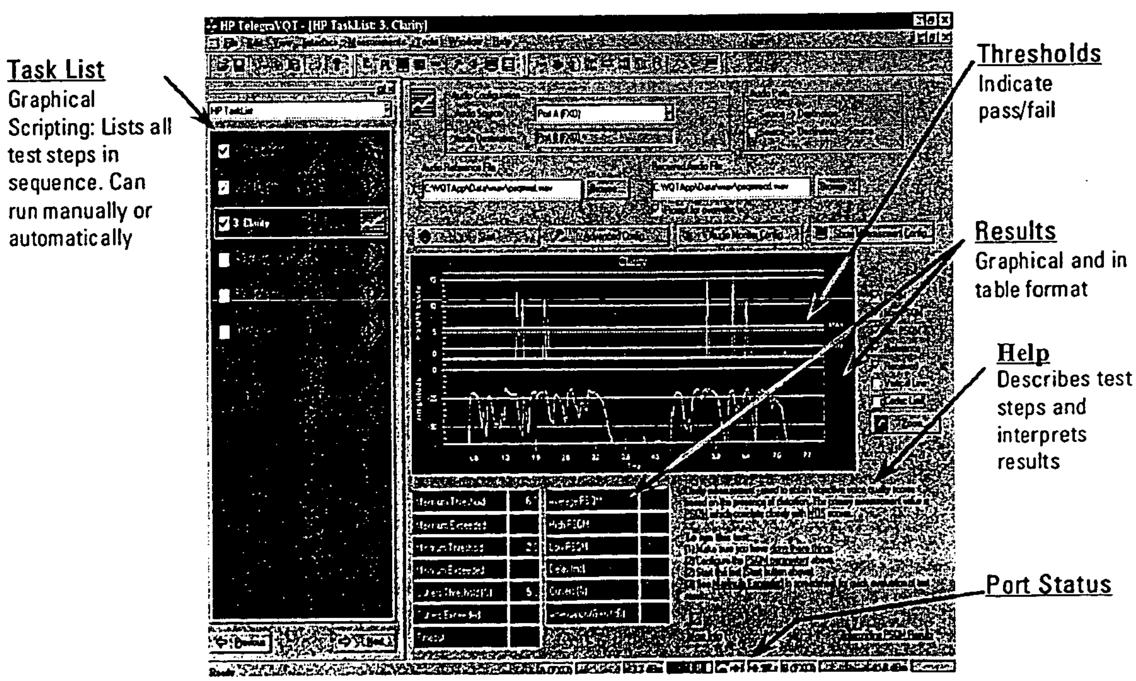
- Clarity
  - Speech quality measurement using the Perceptual Analysis Measurement System (PAMS). PAMS is an innovative technique based on a perceptual model of human hearing. The impacts of a wide range of network-induced distortions, including voice coding and packet loss, are measured and reflected in scores that correlate to Mean Opion Scores on a scale of 1-5.
  - PAMS graphs the error surface showing signal loss and additive distortion, over the time and frequency domains of the test signal.
  - Speech Quality measurement via PSQM+ - based on ITU-T P.861 but improved for network effects such as severe distortions and time clipping which can be generated through packet loss.
  - Presents PSQM scores graphically over time for the entire measurement period, correlated with the test and reference signals."
  - Generates and analyzes PSQM with real speech, including 144 different voice samples in 8 different languages: Japanese, English-North America, English/Britain, French, German, Spanish, Chinese/Beijing (Mandarin) and Chinese/Canton (Cantonese).
- Delay Measurement
  - High reliability via VF signal cross-correlation.
  - One millisecond resolution.
  - Single delay measurement and trend analysis.
- Echo Measurements
  - Detect echo in a voice transmission and measure its impact on clarity.
  - Measure performance of echo cancelers under conditions of Doubletalk.

- Voice Activation Detection Analysis - determines the effectiveness of the voice activity detector (VAD) by measuring
  - Silence suppression - front end clipping (FEC) and holdover time (HOT)
  - Comfort noise generation match with background noise
- DTMF Tone Analysis -analysis of DTMF tone degradation through a network by graphing the distortion parameters including attenuation, twist, and frequency shift
- Capture and analyze network characteristics - captures and graphs the time response of a tail-end circuit or any other linear network
- Network Simulation - simulate networks in your lab using previously measured network characteristic
- Provides analog FXO, analog E&M, T1, E1, and ISDN PRI interfaces to test at different access points and across different types of networks
- Generate calls and load traffic on multiple T1/E1 channels simultaneously, to test voice quality under various traffic conditions
- Automated task lists enable unattended testing
  - Fast and efficient testing
  - Great for setting up tests by experts, to be ran off-site or by novice users
- Built for novice and expert users –
  - A self-explanatory user interface and pre-designed scripts allow you to easily execute every test and identify problems quickly
  - Experts have access to all test parameters and settings, locally or remotely. Test scripts can be developed or existing ones changed. (user can store hundreds of tests on a single VQT)

You Do Not Need To Be A Voice Quality Expert To Operate This System!

Today, more developers and field engineers than ever are faced with the challenge of analyzing voice quality. For the Telegra VQT, ease of use was one of the primary design goals. A self-explanatory user interface and pre-designed scripts allow the user to easily execute every test and identify problems quickly. Default parameters are set for every test and an integrated help window explains test steps and gives guidance on how to interpret results. On the other hand, experts have access to all test parameters and result details than enable them to extract even more information.

<u>Flat User Interface</u> - configuration and measurement information on one screen
Same concept and layout for all measurements



Telegra VQT provides a consistent task oriented user interface across all measurements. A taskbar allows users to execute all measurements in the correct order and to switch easily between measurements. All measurements provide configuration and result information on the same screen. Results are represented graphical and as text at the same time. User definable thresholds can be set to identify easily the pass or fail.

All measurement results are logged for later detailed analysis. Remote controllability allows the user to operate the test remotely.

Clarity - Measuring The Human Perception

Clarity can also be described as speech intelligibility, indicating how much information can be extracted from a conversation. Speech intelligibility depends on a large variety of influencing factors such as quality of the speaker and microphone, speech codecs, compression, packetization in VoIP networks and the effects of packet-loss and jitter. Measuring just these effects is not sufficient because the human brain is able to compensate for some of these shortcomings. This requires a more sophisticated method of analysis.

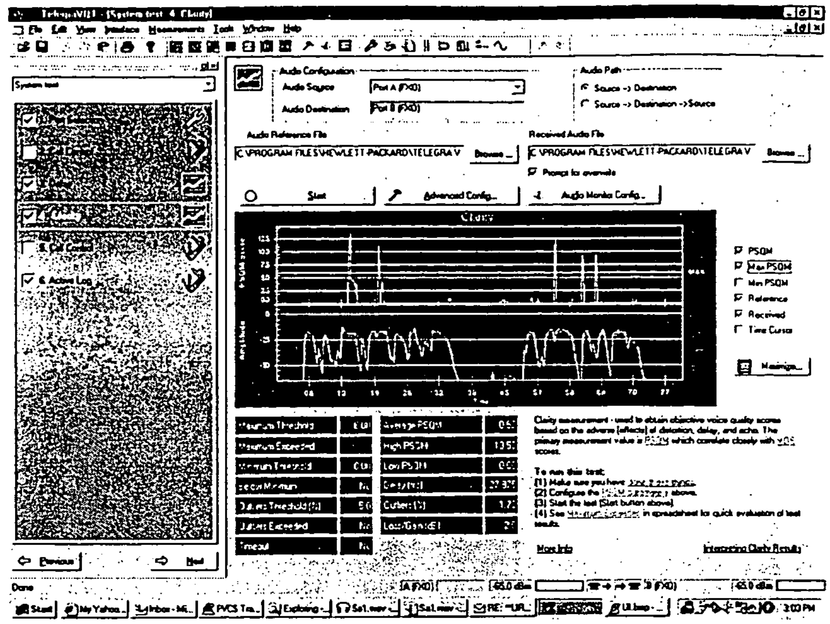
The Telegra VQT offers two innovative methods for measuring speech quality: PSQM+ and PAMS.

PSQM+

The Telegra VQT transmits actual human speech across the network and uses the industry standard ITU-T P.861 Perceptual Speech Quality Measure (PSQM) to objectively measure how clear the audio is at the receiving end. Designed for analysis of compressed voice, PSQM is a cognitive model that objectively determines how people perceive the audio quality. Especially for the effects of voice over packet or cell networks the Telegra VQT uses an enhanced version of PSQM, known as PSQM+, in order to account for severe distortions and time clipping as experienced in packet networks.

The PSQM measurement is actually performed with real human speech by comparing the reference and received signals. The VQT offers 144 different voice samples in 8 different languages to allow you to measure the network behavior for many different users. The VQT also provides the equivalent Mean Opinion Score (MOS) for every PSQM measurement.

In addition to presenting the maximum, minimum and average PSQM score the Telegra VQT also provides a graphical representation of the PSQM scores over time during the entire speech sample, and reports the standard deviation. This allows the user to identify network effects that influence the speech quality such as packet loss. To compensate for network delay, the received signal is time aligned with the reference signal to allow an accurate PSQM measurement.



PAMS

The Perceptual Analysis Measurement System (PAMS) is a valuable tool for providing an objective measurement of speech quality. It uses a perceptual model based on human hearing factors, and provides a repeatable, objective means for measuring perceived speech quality. PAMS uses a different signal processing model than the ITU P.861 standard PSQM, and produces different types of scores. It provides a "Listening Quality Score" and a "Listening Effort Score", both which correlate to MOS scores on a 1-5 scale.

In addition to the listening scores, the VQT provides a graphical representation of signal loss and additive distortion over both the time and frequency domains of the test signal. This is known as the error surface. The error surface shows the impacts of a wide range of network-induced distortions, including coding distortion, front-end clipping, muting, noise, and bit or frame errors. The amplitude of errors is related to how audible and annoying they will be.

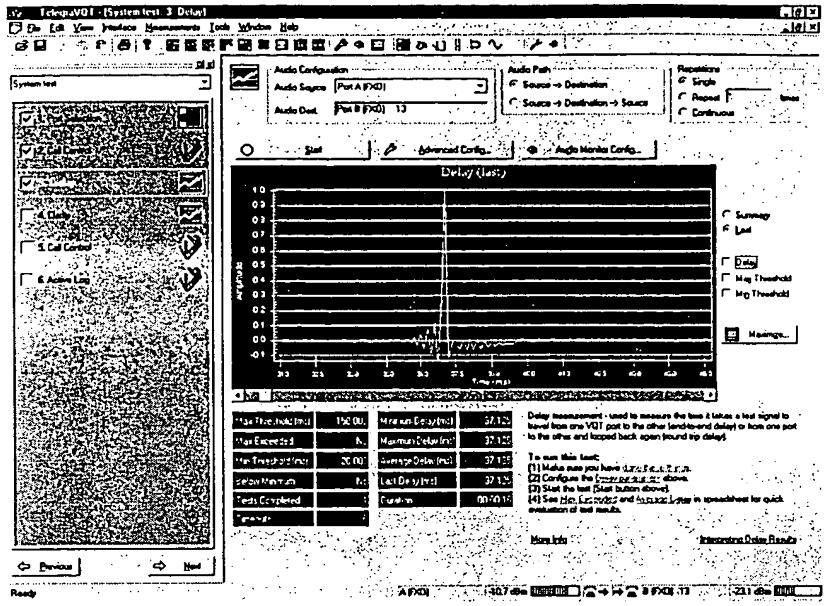
In addition to single clarity measurements Telegra VQT also allows trend analysis over a period of time. This provides essential data to understand network performance variations over the course of an hour, a day or more.

Delay - No Longer Just An International Long-Distance Problem

Delay is the time required for a signal to traverse the network. In a telephony context, end-to-end delay is the time required for a signal generated at the talker's mouth to reach the listener's ear.

Telegra VQT provides a very accurate way of measuring delay, via an impulse response measurement using a Maximum Length Sequence (MLS) noise burst. This pseudorandom noise appears like white noise, and allows the user to determine the delay behavior of a network across all frequencies. The impulse response is graphed and the user can visually inspect the delay results. The MLS signal enables highly accurate time-correlation of the transmitted and received signals, allowing the delay for the entire transmission of a signal to be accurately measured. Both end-to-end and round-trip delay measurements can be performed.

In addition to single delay measurement, Telegra VQT also allows to perform multiple delay measurements. It graphs delay over time and also calculates average, minimum and maximum delay.



Echo - Go Beyond Simple Detection

Echo is a phenonmenom introduced by hybrid wire junctions in circuit-switched networks. Echo can have a detrimental effect on voice quality if the delay and signal level are great enough. But until now, measuring that effect has been elusive.

The Telegra VQT provides two key echo measurements. The Perceived Annoyance Caused by Echo (PACE) measurement detects voice echo and determines the impact that echo has on a speaker's perception of voice quality. The Telegra VQT transmits a sample of human voice and measures the return echo. PSQM scoring is applied to the superimposition of the received echo on the originally transmitted voice, using the originally transmitted voice as the reference signal. The Telegra VQT presents useful information:

- The signal levels of both the transmitted signal and any received echo are graphed and presented in the time domain.
- PSQM scoring is graphed, correlated with the transmitted signal and the echo signal
- Average and maximum PSQM scores are individually reported
- Delay of tail-circuit echo is presented.
- Each duration of echo received during speech, and each duration of echo received during silence, are distinguished and graphed
- The total duration of echo received during speech, and the total duration of echo received during silence, are individually reported in milliseconds.
- The percentage of a voice transmission that is echo-free is reported.

Tail-end echo can be measured using the Telegra VQT's E&M ports, which ensure no origination-side echo will be encountered. Origination-side echo, or immediate echo, can be measured using the Telegra VQT's FXO ports. In addition, the Telegra VQT can simulate echo on its destination port. A network simulator function applied to the destination port can provide varying degrees of delay and return loss to a signal, to simulate echo and exercise the capabilities of echo cancellers.

The second key echo measurement is Echo Doubletalk. This measures the performance of echo cancelers in canceling the echo of one speaker's voice while passing through another simultaneous speaker's voice unimpaired. The VQT applies the condition of Doubletalk by transmitting simultaneous voice in both directions. It measures the clarity of the voice in one direction, the "Doubletalk" signal. Any impacts due to the uncanceled echo of the other speaker, or impairments on the Doubletalk signal, are detected and measured.

Simulate Real Network Behavior In The Lab

Testing systems under real-life network conditions in the lab can help to shorten deployment time and identify problems early. The approach is as follows:

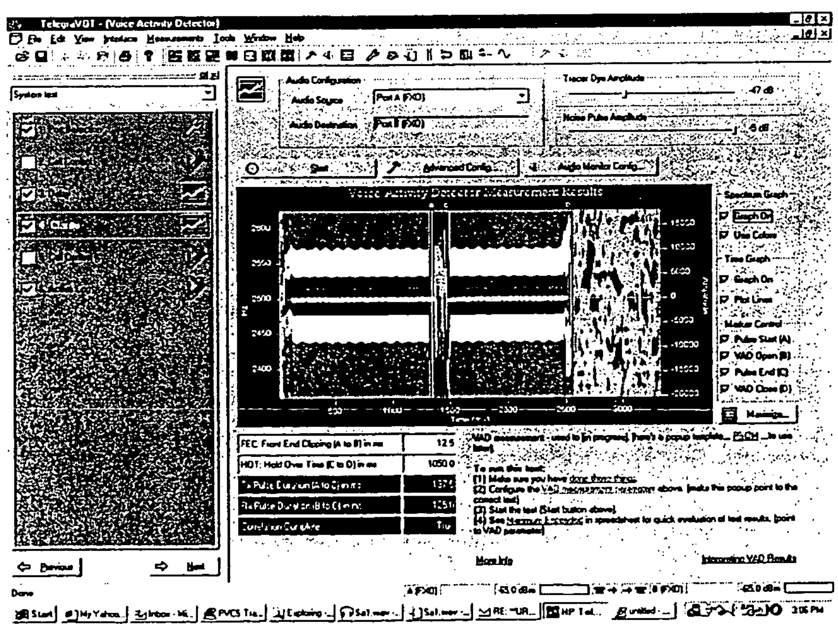
1. In the field, capture the network characteristic of an actual tail-end network by using the Telegra VQT impulse response measurement. Sending out white noise into the network, the transfer function of the network is captured. Telegra VQT presents the impulse response in the time domain measuring network delay.

2. Back in the lab the voice system such as a VoIP gateway can than be connected to the Telegra VQT analog ports. Using the previously captured network behavior Telegra VQT simulates the network behavior. The impact on the voice quality can be determined and gain and delay can be varied to determine the influence of these factors.

This enables the developer or system integrator to determine the behavior of the voice system under real-life conditions right in the lab. The impact on the voice quality can be determined and changes to the design or system settings can be validated immediately. Changing gain or delay of the filter characteristics can simulate the effects of shorter or longer tail-end circuits, additional or less distance or number of nodes. It can also be used to determine boundary conditions under which the system is still working appropriately.

VAD

Voice activity detectors are implemented in voice gateways and are responsible for silence suppression and comfort noise generation. Silence suppression makes use of the fact that human conversations typically comprise more silence than speech from each speaker. Silence suppression stops digitizing when no voice signal is present. This can realize approximately 50% reduction in bandwidth requirements. During periods of this silence, the listener still expects to hear some background noise to confirm that the connection is still active. A Comfort Noise Generator at the receive-side generates a background noise signal matching the real noise on the line to the listener during these silence periods.



To identify the appropriate function of these network components the Telegra VQT provides a VAD measurement to accurately measure the behavior of the silence suppressor and the comfort noise generator. The VAD measurement determines the following parameters:

- Front-end clipping - the time the VAD needs to detect the speech signal and how much of this signal got cut off. Listeners can be very annoyed by Front-End-Clipping if it makes the first word of each sentence difficult to under stand.

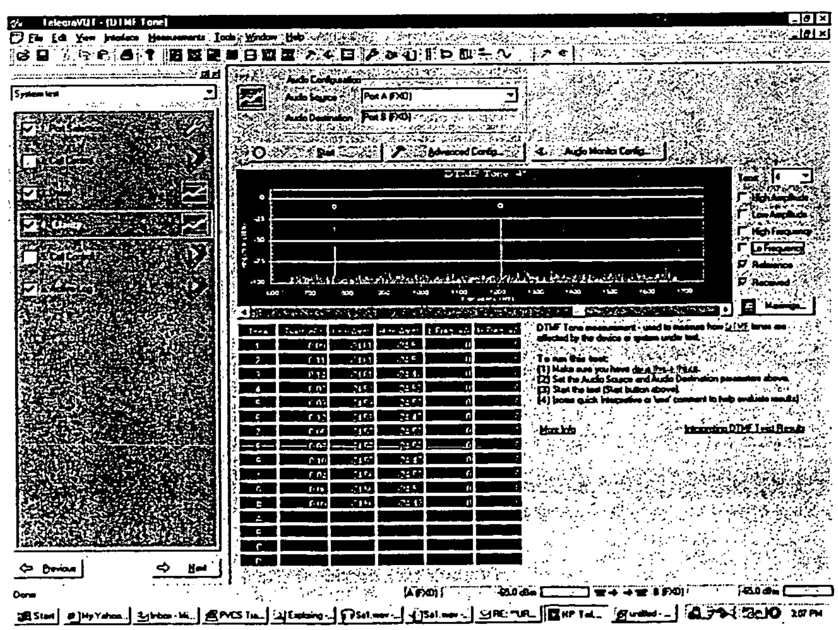
- Holdover time - the time the VAD continues to send data, even after the speaker stopped talking. A conservative/long holdover time will utilize bandwidth unnecessarily sending background noise; an aggressive/short holdover time will potentially stop the voice transmission even in short pauses between words. This can make the front-end-clipping very perceptible and annoy the listener.

- The match between the generated "comfort" noise and the "true" background noise. A noticeable difference in sound can be annoying to both speaker and listener

These VAD measurement results are presented graphically as well as in text form.

DTMF

DTMF stands for Dual-Tone Multi Frequency and is the tone generated by each key of a touch-tone phone. Transmitting DTMF tones through digital networks can be especially difficult with low bit-rate voice codecs, which are tuned to encode speech, a non-sine wave signal. DTMF, however, transmits two distinct sine-wave frequencies per key and low-bit-rate codecs often have difficulty recreating these signals. This can make it impossible to communicate with a voice message or interactive voice response system.



Telegra VQT provides the ability to determine how distorted these DTMF tone are when transmitted across a network. The system determines DTMF twist, the difference between the high frequency and low frequency amplitude. It presents send and received DTMF frequency to visualize the difference between the two tones. In addition it shows the results in tabular format, including amplitude and difference in peak frequency.

Automated Testing

The VQT's easy-to-use interface enables both interactive and automated testing. The VQT's graphical task lists can be saved and executed automatically, with precise configurations set for each task list. This allows unattended testing and efficent high-volume testing. Execution can be via the GUI or a command line interface.

Related Literature

Telegra D	Product Overview	5968-5651E
Telegra M	Product Overview	5968-5652E
Telegra VQT	Technical Specification	5968-8811E

Warranty

Hardware: 1 year
Software: 90 day replacement only

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This Product is Y2K Compliant

Agilent Ordering Information

J1981A	Telegra R Voice Quality Tester
Opt. 200	Dual-port analog FXO and dual-port analog E&M interface
Opt. 201	Dual-port T1 interface
Opt. 202	Dual-port E1 interface
Opt. 400	PAMS for clarity measurements
Opt. 401	PSQM for clarity measurements

Instructor Led Training CBT

H7211B	Essentials of VoIP Protocols
Opt. 207	Instructor Led Training

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Do you have a budget set for this application?

- ☐ Yes
- ☐ No
- ☐ In process

What is your time frame to implement this product?

- ☐ 30 days
- ☐ 180 days
- ☐ 90 days
- ☐ Other – (please define) __________

Product(s) of Interest

☐ ***The Agilent Advisor*** – Integrated, High-Performance Troubleshooting for:

____ Advisor LAN
____ Advisor WAN
____ Advisor ATM

☐ ***The LAN Analyzer*** – Scaleable Ethernet and Token Ring Test Solutions

☐ ***Telegra Fax Test*** – Fax Protocol and Low Generation Analysis

☐ ***Telegra Voice Quality Tester*** – Detailed Voice Analysis for Clarity, Echo and Delay using PSQM and PAMS

☐ ***Telegra Voice and Fax over IP*** – Protocol Analysis

☐ ***FASTest*** – Automated Service Verification for PSTN and IP Networks

What is the main problem you need to solve on your network?

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